Newton's Second Law Math problems

Name _____ Hr____ /32pts

Information you need:

FORMULA: FORCE = MASS x ACCELERATION
Force is measured in *Newtons*.
Mass is measured in Kg
Acceleration is measured in m/sec^2 (meters per second every second)
Acceleration due to gravity is 9.81 m/s^2.

EXAMPLE: Engineers at the Johnson Space Center must determine the net force needed for a rocket to achieve an acceleration of 70 m/s2. If the mass of the rocket is 45,000 kg, how much net force must the rocket develop?

Using Newton's second law, F=ma

F=(45,000 kg)(70 m/s2)

F= 3,150,000 kg* m/s2

F= 3,150,000 Newtons

Note that the unit kg m/s2 translates into a Newton

1. What net force is required to accelerate a car at a rate of 2 m/s2 if the car has a mass of 3,000 kg?

   F=

   m=

   a=

2. A 10 kg bowling ball would require what force to accelerate down an alleyway at a rate of 3 m/s2?

   F=

   m=

   a=

3. Sally has a car that accelerates at 5 m/s2. If the car has a mass of 2000 kg, how much force does the car produce?

   F=

   m=

   a=

4. What is the mass of a falling rock if it produces a force of 147 N?

   F=

   m=

   a=

5. What is the mass of a truck if it produces a force of 14,000 N while accelerating at a rate of 5 m/s^2 ?

   F=

   m=

   a=

6. What is the acceleration of softball if it has a mass of 0.5 kg and hits the catcher's glove with a force of 25 N?

   F=

   m=

   a=

7. Your own car has a mass of 2000 kg. If your car produces a force of 5000 N, how fast will it accelerate?

   F=

   m=

   a=

8. Sally wants to accelerate even faster than in problem #3, so she removes 500 kg of mass from her car. How fast will her 1500 kg car accelerate if it produces 5000 N of force?

    F=

    m=

    a=

9. Sally challenges you to a race. On the first turn you run off the course and your car strikes a large bale of hay. Your car still produces 5000 N of force, but now it accelerates at only 2 m/s2. What is the mass of your car now that the bale of hay is stuck to it?

    F=

    m=

    a=

10. Even though she is way ahead of you, Sally switches her car to run on nitrous oxide fuel. The nitrous oxide allows her car to develop 10,000 N of force. What is Sally's acceleration if her car has a mass of 500 kg?

    F=

    m=

    a=

11. An automobile with a mass of 1000 kilograms accelerates when the traffic light turns green. If the net force on the car is 4000 Newtons, what is the car’s acceleration?

12. Calculate the acceleration of a 2000-kg, single-engine airplane just before takeoff when the thrust of its engine is 500 N.

13. Calculate the acceleration of a 300,000 kg jumbo jet just before takeoff when the thrust for each of its four engines is 30,000N.

14. Calculate the horizontal force that must be applied to a 1-kg puck to make it accelerate on a horizontal friction-free air table with the same acceleration it would have if it were dropped and fell freely.

15. What is the weight on earth of a girl with a mass of 30 kg?

16. An occupant of a car has a chance of surviving a crash if the deceleration during the crash is not more than 30 g. Calculate the force on a 70-kg person decelerating at the same rate.